

DOCUMENT RESUME

ED 153 054

CE 015 769

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TITLE X-Ray Equipment and Protective Devices of Dental Assistant Programs in Pennsylvania Vocational Technical Schools. Vocational-Technical Education Research Report, Health Occupations, Monograph No. 7, Vol. 16, No. 1.
INSTITUTION Pennsylvania State Univ., University Park. Div. of Occupational and Vocational Studies.
PUB DATE Feb 78
NOTE 59p.
EDRS PRICE MF-\$0.83 HC-\$3.50 Plus Postage.
DESCRIPTORS *Classroom Design; *Dental Assistants; Health Occupations Education; Post Secondary Education; Radiation; *Safety Equipment; *School Safety; Secondary Education; State Surveys; *Vocational Schools
IDENTIFIERS Pennsylvania; *X Ray Machines

ABSTRACT

Objectives of a Pennsylvania study were (1) to investigate the ways in which the vocational technical schools of the state have met the recommendations of the Pennsylvania Department of Environmental Resources for classroom structural design and dental x-ray machines in dental assistant training programs and (2) to collect data on the methods by which these recommendations have been met in order to provide information for the planning of new dental assistant programs. A questionnaire was prepared to gather data on the programs and on the structural materials, protective devices and techniques, and the design of the classrooms currently in use to safeguard students against possible unnecessary exposure to radiation in the dental assistant classroom. Of the nineteen dental assistant and sixty health assistant programs in the state, about half in each category responded. Results showed that the majority of programs offering dental assisting have been in existence five years or more and have one- to two-year course offerings. The majority of respondents did not know the structural materials of the room in which dental x-ray machines were located. Most programs satisfied safety requirements for the machine itself and protective lead shielding for the operator; however, the classroom design in most cases would necessitate a protective shielding of other areas of instruction and such was not provided. Some programs did not have dental x-ray machines and some had non-operable ones for mock demonstration only. Recommendations were made regarding provision of safe equipment but also for further study on the need for x-ray equipment and the effectiveness of its use in training. (The questionnaire is appended.) (JT)

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ED153054

X-Ray Equipment and Protective Devices
of Dental Assistant Programs in Pennsylvania
Vocational Technical Schools

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CE 015 769

February 1978

U.S. DEPARTMENT OF HEALTH,
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ABSTRACT

X-Ray Equipment and Protective Devices of Dental Assistant Programs in Pennsylvania Vocational Technical Schools

Purpose

The purpose of this study was to investigate the design, structural materials and the dental X-ray machines used in the Vocational Technical Schools of Pennsylvania. The specific areas of concern were:

1. The type of materials used in the wall section surrounding the area in which the dental X-ray machine is used.
2. The architectural design of the room in which the dental X-ray machine is used.
3. Other types of materials and devices used to provide protection from radiation.
4. The type of dental X-ray equipment used.
5. Techniques applied in the use of the dental X-ray equipment.
6. Frequency in the use of dental X-ray equipment.

Objectives

1. To determine whether recommendations of the Pennsylvania Department of Environmental Resources in designing the instructional area for the use of dental X-ray equipment have been met most effectively and economically.

2. To provide a plan of structural design, structural materials and dental X-ray equipment to aid in the planning of future Dental Assistant and Health Assistant programs in Pennsylvania.

Outcomes

The outcomes of this study were accomplished through a survey questionnaire sent to Dental Assistant and Health Assistant programs in the Vocational Technical Schools of Pennsylvania. The questionnaire was constructed in four sections: the program, the dental X-ray room structural materials, the dental X-ray machine and the design of the classroom.

Audience

The nineteen Dental Assistant and sixty Health Assistant programs in Pennsylvania were surveyed and provided data for this study.

Chapter I

INTRODUCTION

Introduction

It is most important in an educational institution that a student's exposure to radiation be kept to a minimum. In order to achieve this goal, the Pennsylvania Department of Environmental Resources has issued recommendations on building structure, design and proper use of dental x-ray machines. The objective of this report is to investigate the structural design of the Dental Assistant classrooms and the dental x-ray machines associated with the Vocational Technical Schools of Pennsylvania.

Every person today lies prey to cosmic rays and radiation from radioactive materials in the atmosphere, such as earth, rocks, building materials, etc. In addition to this, the human body also contains radioactive substances such as potassium, cesium and radium. Other sources of radiation exposure are medical x-rays and those resulting from the development of Nuclear Technology.

Background of Study

Radiation effects on humans consists of two general types. The SOMATIC EFFECT results from injury to the body tissues of the irradiated individual. The doses of radiation necessary to produce the somatic effect are considerable. High doses in an educational institution could be received by an individual only as the result of gross careless-

ness or of ignorance to the presence of radiation.

The second type of injury by radiation is the GENETIC EFFECT in which the germ plasm of the irradiated person is affected. The injury would not be apparent in the individual but might become evident in the transmission of hereditary defects in the descendants. There does not appear to be a low limit to the amount of radiation which may produce some genetic effect, the extent of which may be expected to increase with the dose of radiation. Once the dose has been received, there probably is little recovery from its effects. It is most important to keep irradiation of the reproductive organs of an individual to a minimum from the moment of conception into the end of his/her reproductive years.

The vocational students should learn the basic theories to assure adequate protection from radiation injuries: (1) they must learn to protect themselves and others who might be exposed through their use of x-rays and (2) they must become skilled in the proper use of the x-ray equipment.

There is a high correlation between the increased need for skilled persons in the health professions and the rapid growth of the health occupations students in the Vocational Technical Schools of Pennsylvania. (Borkovich and Welch, 1975) With this increase in the health care services areas of education, the Pennsylvania Department of Environmental Resources has recognized the critical need to publish suggested guidelines for the structural design of the classrooms in which dental x-ray equipment will be used. They have also published recommendations in the use, protection, and guidelines to follow when a student is using this equipment. (Title 25, Part I, Chapter

229, Human Use of Radiation-Producing Machines or Equipment, 1976)

These recommended safety measures, employed by the students in training, will then be carried into their performance in the dental occupation.

Statement of the Problem

The purpose of this study was to investigate the design, structural materials and the dental x-ray machines used in the Vocational Technical Schools of Pennsylvania. The specific areas of concern were:

1. The type of materials used in the wall section surrounding the area in which the dental x-ray machine is used.
2. The architectural design of the room in which the dental x-ray machine is used.
3. Other types of materials and devices used to provide protection from radiation.
4. The type of dental x-ray equipment used.
5. Techniques applied in the use of the dental x-ray equipment.
6. Frequency in the use of the dental x-ray equipment.

The study deals primarily with secondary Dental Assistant and Health Assistant programs in Pennsylvania and to a minor extent covers post-secondary programs.

This study is limited by the fact that only the Vocational Technical Schools in Pennsylvania have been surveyed to collect the data for this investigation.

Need for the Study

To date, there has been very little research into adequate design incorporating the recommended protective provisions against radiation from dental x-ray equipment, in Dental Assistant classrooms in the Vocational Technical Schools in Pennsylvania. The Pennsylvania Department of Environmental Resources has stepped forward in recommending ground rules that educators can employ in providing for new departments and updating facilities in existing schools in this training area.

There are a variety of ways in which the recommendations of the Pennsylvania Department of Environmental Resources may be met in designing the instructional area for the use of the dental x-ray equipment. The purpose of this study was to determine whether or not these recommendations have been met most effectively and economically.

It was felt that through this research, a plan of structural design, structural materials and dental x-ray equipment will be available to aid in the planning of future Dental Assistant programs in Pennsylvania.

Definition of Terms

The following definition was extracted from the Pennsylvania Department of Education publication of 1971 An Instruction Guide for Teachers of Dental Assistants. Dental Assistant: A Dental Assistant

is a person trained to assist the licensed dentist in his office, group practice, dental clinics or federal agencies. Today a Dental Assistant's primary function is to assist the dentist at chairside. A recent regulation of the State Dental Council and Examining Board has increased the scope of the procedures that the assistant may perform under the direct supervision of the dentist. Certain laboratory duties may also be performed, and in some offices the assistant may work as a receptionist

and secretary.

The following definition was extracted from the Pennsylvania Department of Education publication of 1969, An Instruction Guide for Teachers of Health Assistants. Health Assistant: A Health Assistant

is an entry worker in many health occupations serving as an assistant in many areas and always working under the direct supervision of the professional to whom the assistant is assigned: Performing simple bedside procedures as assigned by the nurse. Performs simple tasks as assigned by other health facility workers (physical therapy, occupational therapy, central supply). May serve as a ward clerk and may perform other clerical duties in health care facilities. Assists physicians and/or dentists in their offices. May perform simple laboratory procedures.

The following definitions were extracted from the National Council on Radiation Protection and Measurements, Radiation Protection for Medical and Allied Health Personnel. Lead Shield, Lead Lined Drapery and Lead Screen: The term defined as protective barrier would apply to these terms: a barrier of radiation-attenuating material used to reduce radiation exposure.

Phantom: A volume of tissue-equivalent material used to simulate the absorption and scattered characteristics of a patient's body or of parts thereof.

Structural Materials: Barrier of attenuating materials, used to reduce radiation exposure, incorporated into the structure of a building.

The following definitions were extracted from the National Council on Radiation Protection and Measurements, Radiation Protection in Educational Institutions. Cosmic Rays: High energy ionizing particles or radiations originating beyond the earth's atmosphere.

Exposure: A measure of x or gamma radiation at a certain place, based on its ability to produce ionization in air. The roentgen (R) is a unit of exposure.

Irradiation: Process of exposure to radiation.

Scattered Radiation: Radiation that, during passage through matter, has been deviated in direction and may have had its energy

diminished

The following definitions were extracted from the National Council on Radiation Protection and Measurements, Dental X-ray Protection. Operator: The person actually in control of the equipment when exposures are being made.

Pointer Cone: A means used to indicate the direction of the useful beam and to establish the minimum source-surface distance. It may be a cylinder, a cone, or a truncated cone.

Radiation (ionizing): Radiation capable of producing ions directly or indirectly by interaction with matter. (In this report radiation refers to x-rays.)

Plan for the Study

The Pennsylvania Department of Environmental Resources was contacted for guidelines on the care and use of radiological equipment used in the Dental Assistant programs. They forwarded their published guidelines along with additional information of other published materials that would be useful in this study. (Appendix A)

A survey was prepared (Appendix C) to formulate a conclusion as to the structural materials, protective devices and techniques, and the design of the classrooms currently in use to safeguard students against possible unnecessary exposure to radiation in the Dental Assistant classroom.

This form was mailed to all Dental and Health Assistant instructors in the Vocational Technical Schools in Pennsylvania. The data compiled will help to identify the methods and equipment currently in use in the Dental Assistant programs in Pennsylvania. It can also help to formulate guidelines for future programs and to update

existing Dental Assistant programs in Pennsylvania.

Summary

It is important that the students be protected from radiation during their instruction and use of the dental x-ray equipment. Any unnecessary exposure of the student to radiation could have long lasting genetic effect on the student themselves and also on their descendants.

Due to the increase in the need for trained dental assistants in Pennsylvania there will be a corresponding increase in the Dental Assistant programs offered within the state. In order to aid in the preparation for these programs, this study was done to determine the most common, effectual and economic methods by which the recommendations of the Pennsylvania Department of Environmental Resources have been met for structural materials, classroom design, and dental x-ray equipment.

To date, a minimum amount of research has been done on these aspects of the Dental Assistant programs in the Vocational Technical Schools in Pennsylvania. With the aid of the recommended guidelines by the Pennsylvania Department of Environmental Resources, a survey was compiled and sent to the existing Dental Assistant and Health Assistant programs in Pennsylvania. The data from these surveys has been compiled and reviewed in this study.

Chapter II

REVIEW OF LITERATURE

The extent of this review of related literature was to summarize and to examine comparable data from other studies dealing with the planning of classroom and equipment for the use of dental x-ray machines. In such a review, the author found no articles dealing with the topic of this study. Consequently the review will examine recommendations published on the topic of this study.

In conducting the review of related literature the following resources were used:

1. AIM/ARM data base - a Resource Information Center to obtain information relevant to education.
2. Dissertations - research related to the study developed in this paper.
3. ERIC - Educational Resources Information Center, designed and supported by the United States Office of Education. It is a national information system, a source for obtaining information related to education and a network of decentralized information centers called clearinghouses. It is a key resource for searches requested by VEIN users.
4. VEIN - The information system for the vocational, technical and continuing education practitioner in Pennsylvania. It is supported by the Bureau of Vocational, Technical and Continuing Education for Pennsylvania, and it is free

to its users.

The criteria for guidelines to measure the performance of safety in using the x-ray equipment and the structural adequacy of the Dental Assistant classrooms was derived from the guidelines published by the Pennsylvania Department of Environmental Resources.

They are as follows: Under the Act of January 28, 1966, Pennsylvania Law 1625 & 301 (73 P.S. & 1301). Chapter 229 adopted February 1, 1972, effective March 1, 1972, 2 Pa. B. 212.

229.4 (a) Radiation-producing machines or equipment shall be registered with the Department within 30 days after acquisition of such equipment, and each 4 years thereafter.

229.41 Housing and beam control.

(a) A diagnostic-type protective tube housing shall be used.

(b) Diaphragms or cones shall be used for restricting the useful beam and shall provide the same degree of attenuation as the housing. The diameter of the useful beam at the end of the cone shall not be more than three inches for intra-oral radiography.

(c) A cone or spacer frame shall provide a target-to-skin distance of not less than seven inches with apparatus operating above 55 kVp or four inches with apparatus operating at 55 kVp or below for intra-oral periapical exposures.

229.44 Each installation shall be provided with a protective barrier for the operator or shall be so arranged that the operator may stand at least six feet from the patient and well away from the useful beam.

229.6 (b) Individuals shall not be exposed to the useful beam except for healing arts purposes, each exposure of which has been authorized by a licensed practitioner of the healing arts. This provision specifically prohibits deliberate exposure for the following purpose: (1) Exposure of an individual for training, demonstration or other purposes unless there are also healing arts requirements and proper prescription has been provided.

The National Council on Radiation Protection and Measurements has also published recommendations on dental x-ray protection. The author has referred to the following: The Dental X-ray Protection, NCRP Report #35 1.3.1 states:

Limiting the exposure of individuals other than the patient. Reduction of radiation exposure to an individual from external sources of radiation may be achieved by any one or combination of the following measures:

- (a) Increasing the distance of the individual from the source.
- (b) Reducing the duration of exposure and
- (c) Using protective barriers (shielding) between the individuals and the source. For dental x-ray equipment, protective shielding and distance are the factors most readily controlled. Protective shielding includes that which is incorporated into equipment; it may also consist of mobile or temporary devices used as the occasion demands, such as movable screens; or it may comprise permanent protective barriers and structural shielding, such as walls containing lead, concrete, or other materials in thickness sufficient to provide the required degree of attenuation. Structural shielding is an important part of installation planning.

The National Council on Radiation Protection and Measurements Report #35 also recommended that the barriers for the dental x-ray area be determined by:

- (a) The voltage of the machine being operated.
- (b) The distance from the source of radiation to the position of interest.
- (c) Whether the position of interest is in a controlled or uncontrolled area.
- (d) The weekly workload.

The Occupational Safety and Health Act has also provided for standards of safety in the use of dangerous and hazardous machinery.

They are as follows:

Section 7

Prohibited Use of Dangerous Machinery - If any machinery or any part thereof, is in a dangerous condition or is not properly guarded, the use thereof, may be prohibited by the Secretary of Labor and Industry or his authorized representative, and a notice to that effect shall be attached thereto. Such notice shall be removed only by an authorized representative of the department after the machinery has been made safe and the requirement safeguards are provided, and in the meantime such unsafe or dangerous machinery shall not be used.

Section 2

General Safety and Health Requirements

(a) All establishments shall be so constructed, equipped, arranged, operated and conducted as to provide reasonable and adequate protection for the life, limb, health, safety and morals of all persons employed therein.

Summary

The Pennsylvania Department of Environmental Resources recommended guidelines and the National Council on Radiation Protection and Measurements publications were reviewed and studied. This literature outlined the structural materials, suggestions of room design and design of dental x-ray equipment. From this material, the survey was prepared and sent to the Dental Assistant and Health Assistant programs in the Vocational Technical Schools of Pennsylvania.

Chapter III

METHODOLOGY

The purpose of this study was

(1) to investigate the ways in which the Vocational Technical Schools of Pennsylvania have met the recommendations of the Pennsylvania Department of Environmental Resources for the structural design and dental x-ray machines and

(2) to collect data on the methods by which these recommendations have been met in order to provide information for the planning of new Dental Assistant programs.

Survey Population

The nineteen Dental Assistant and the sixty Health Assistant programs in Pennsylvania were surveyed. A total of twelve Dental Assistant programs, twenty-seven Health Assistant programs and one Medical Health Technology program responded to the survey.

Data Gathering Techniques

The survey questionnaire (Appendix C) along with a letter of explanation (Appendix B) was sent to the instructors of the respective programs requesting them to complete the survey and return for analysis.

Survey Questionnaire

The survey questionnaire (Appendix C) was constructed in four sections. The first section polled the survey population with regard to the type of program and the length of time the program has been in existence.

The second section asked for information concerning the wall section structure of the room containing the dental x-ray machine and any other protective features of the room.

The third section of the survey was directed to the dental x-ray machine features and to the usage of the machine, along with the protective measures available while using the machine.

The fourth section deals with the architectural design of the classroom. This was to provide information as to where the dental x-ray machine was located in respect to the other areas of instruction of the classroom.

Accompanying the survey instrument was a cover letter (Appendix B) explaining the intent of the survey.

Summary

A survey questionnaire sent to the Dental Assistant and Health Assistant programs in the Vocational Technical Schools of Pennsylvania was responded to by twelve Dental Assistant programs, twenty-seven Health Assistant programs and one Medical Health Technology program.

The questionnaire (Appendix C) was constructed in four sections. The sections were namely the program, the dental x-ray room structural

materials, the dental x-ray machine and the design of the classroom.

Chapter IV

FINDINGS

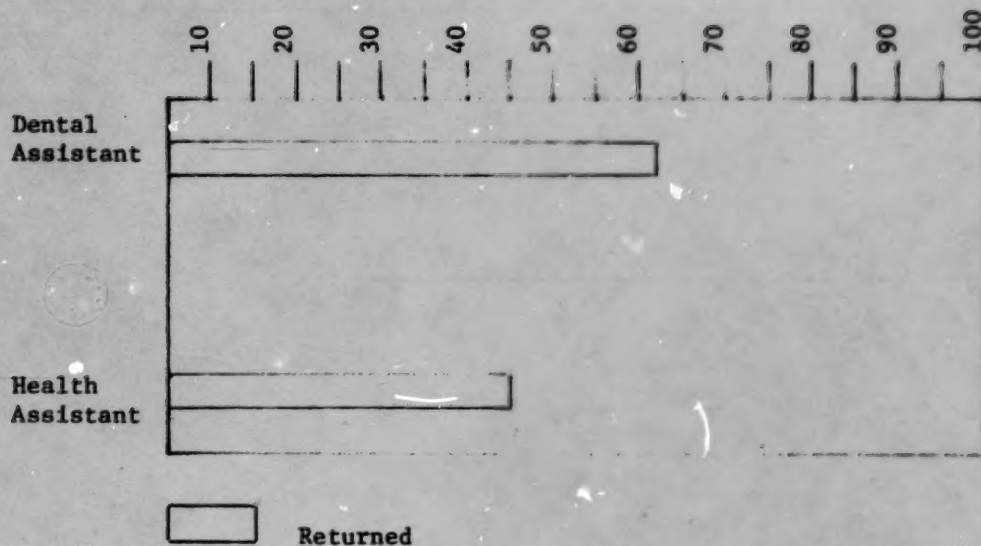
Introduction

The findings of this study will be discussed through the interpretation of charts and information projected through returned surveys. The responses of the survey will be totaled for each question in the specific category asked on the questionnaire. This information is presented in the form of tables and charts where appropriate.

Of the nineteen Dental Assistant programs and the sixty Health Assistant programs that were sent surveys, twelve Dental Assistant programs, twenty-seven Health Assistant programs and one Medical Health Technology program responded. One survey was returned unanswered with the explanation that the Health Assistant program did not teach any Dental Assisting.

Approximately one half of the programs in Pennsylvania did not respond to the survey.

Table 1. Response of Surveys

**Conclusion:**

As shown in Table 1, sixty-three percent of the Dental Assistant programs polled responded to the survey and forty-five percent of the Health Assistant programs contacted responded to the survey. Of the total population surveyed, fifty-six percent responded to the poll.

P R O G R A MQUESTIONS #1, 5, 6

Table 2. Distribution of Length of Time Schools and Programs Have Been in Operation and Length of Programs.

QUESTION #	1 Years	2 Years	3 Years	4 Years	5 Years	No Answer
1. How many years has the school been in operation?		2			37	1
5. How many years has the program been in operation?		6	2	3	28	1
6. What is the length of your program of instruction?	14	20	5			1

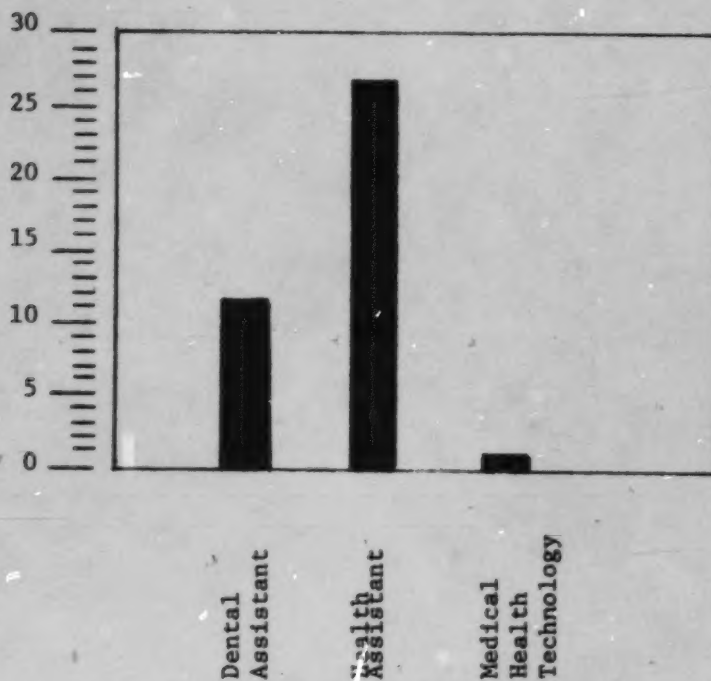
Conclusion:

As found in Table 2, most of the schools answering the survey have been operating for five years or more. Also, the majority of the programs offering the Dental Assistant course began when the school opened for instruction. This would indicate that there has been an immediate need for trained dental assistants in Pennsylvania. The current trend in the length of the programs was one to two years in length.

QUESTION #2

What is the title of your program?

Table 3. Titles of Programs Responding.



Conclusion:

In Table 3, the forty schools responding were twelve Dental Assistant programs, twenty-seven Health Assistant programs and one Medical Health Technology program. A greater percentage of the Dental Assistant programs responded than did the Health Assistant programs.

QUESTION #3

If the answer to Question #2 is not Dental Assistant, is Dental Assistant taught as part of your program?

In response to this question, twenty-five of the programs not titled Dental Assistant offered Dental Assisting as part of their program of instruction but three did not.

QUESTION #4

Did the program begin when the school was opened for operation?

There were a total of twenty-two programs that began with the inception of the school and seventeen were added after the school was in operation. It was felt that in asking this question it would perhaps help to explain the structural design or materials used in the room.

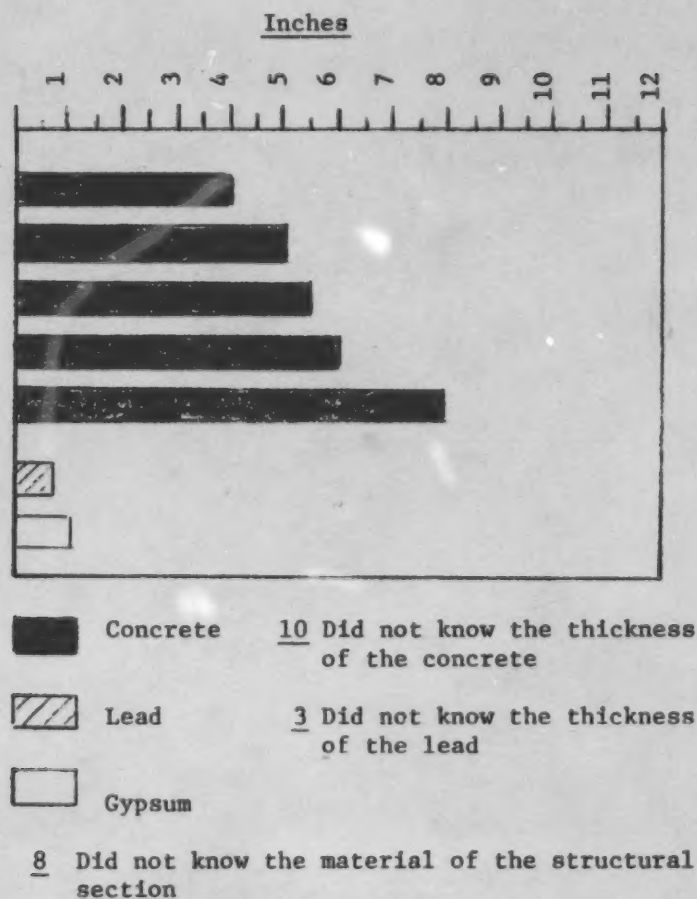
DENTAL X-RAY ROOM

QUESTION #1

The structural wall section of the room which contains the dental x-ray machine is made of

- A. Concrete inches
 B. Lead shielding inches
 C. Gypsum board inches
 D. Do not know

Table 4. Structural Wall Material.

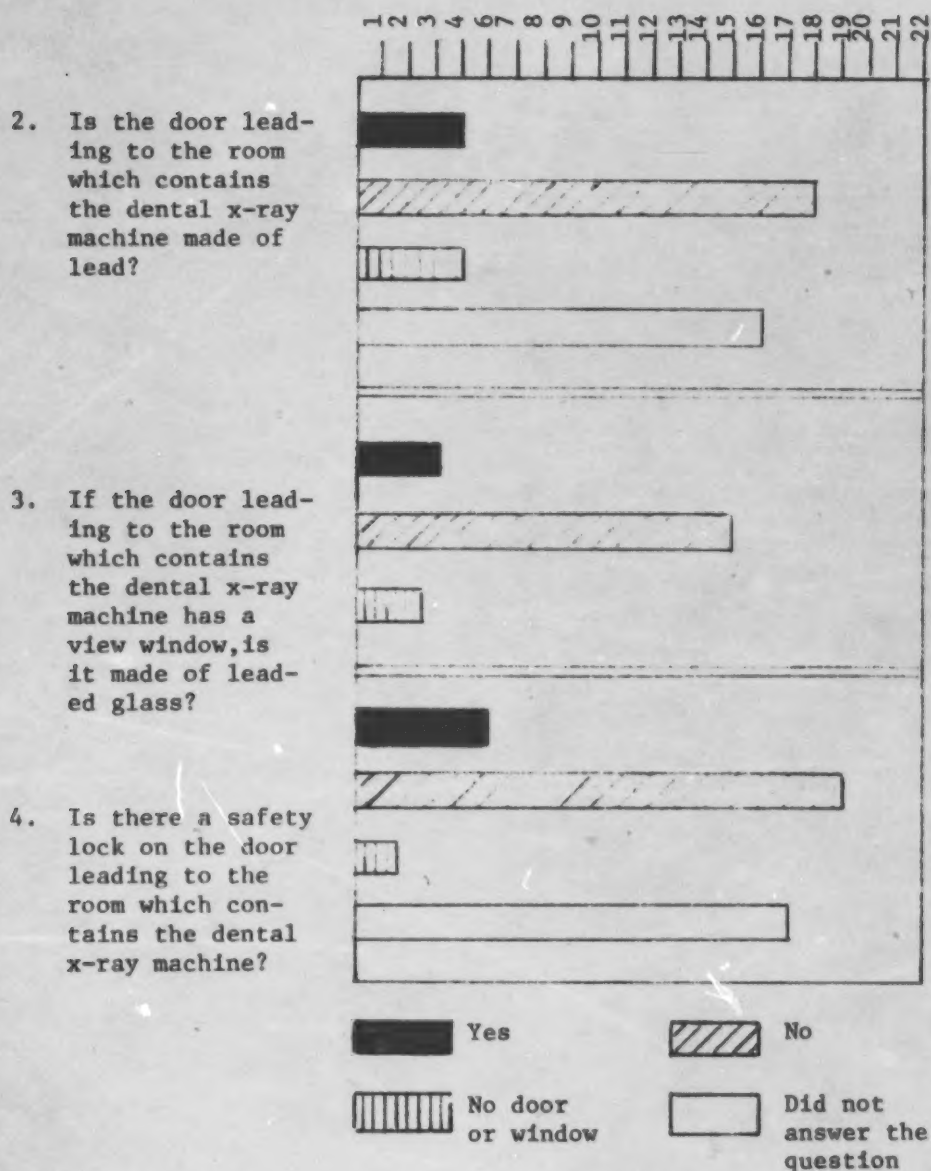


Conclusion:

As shown in Table 4, most of the structural wall sections of the dental x-ray rooms are made of concrete but the thickness is not known. Eight of the responding programs did not know the structural wall material and thirteen of the surveys did not answer this question.

QUESTIONS #2, 3, 4

Table 5. Safety Features of Door Leading to Dental X-ray Room.



Conclusion:

Of the responses in Table 5, most of the doors leading to

the room containing the dental x-ray machine contain neither lead, leaded glass view window or a safety lock. There were a large number of surveys on which these questions were not answered.

QUESTION #5

Answer this question only if the classroom containing the dental x-ray equipment is located on the second floor of the building.

Is the floor of the room constructed with

- ☐ A. Concrete ___ inches
- ☐ B. Lead shielding ___ inches
- ☐ C. Do not know

Five of the surveys responded that the floor of the room was made of concrete but did not know the thickness. On thirty-five of the responses, the question did not apply.

QUESTION #6

Answer this question only if the classroom containing the dental x-ray equipment has a classroom located above it.

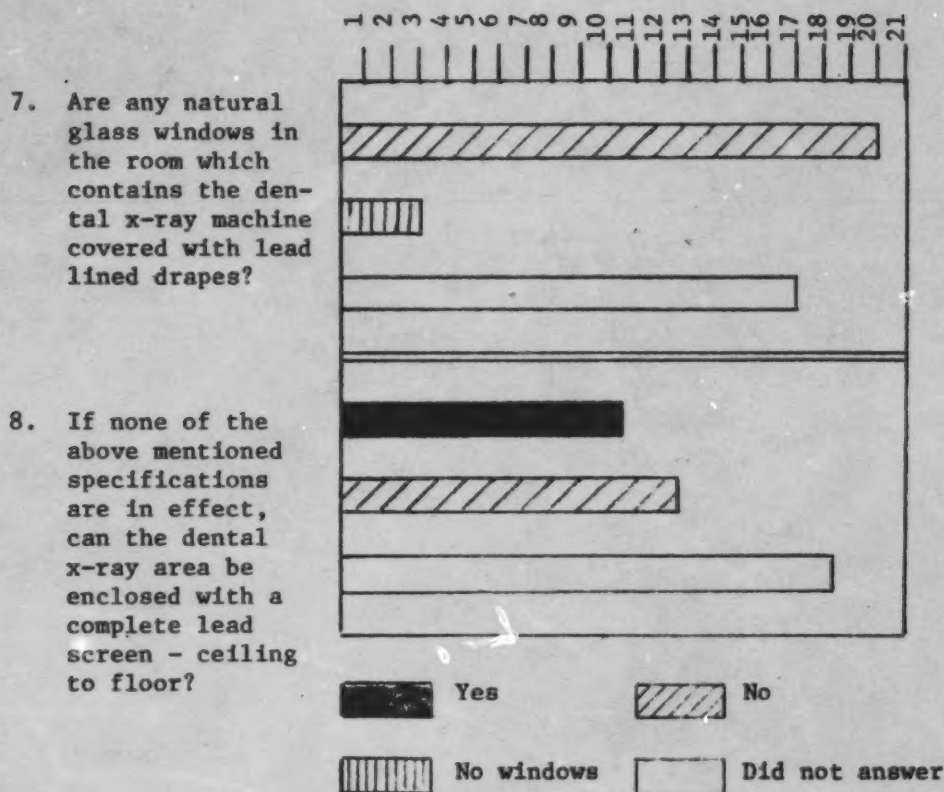
Is the ceiling of the classroom constructed of

- ☐ A. Concrete ___ inches
- ☐ B. Lead shielding ___ inches
- ☐ C. Gypsum board ___ inches
- ☐ D. Do not know

The responses to the survey were that one has a ceiling made of concrete but the thickness was unknown; one did not know and in thirty-eight responses, the question did not apply.

QUESTIONS #7, 8

Table 6. Protection in the Dental X-ray Room.

**Conclusion:**

As found in Table 6, the responding programs do not have any natural glass windows protected against the possibility of the radiation scattering when it beams onto the natural glass. They also do not have any method of screening the dental x-ray unit from the remainder of the classroom.

Again, there were a large number who did not respond to this question.

DENTAL X-RAY MACHINEQUESTION #1

What is the brand name of the dental x-ray machine used in the program?

Table 7. Brands Of Dental X-ray Machines

	1	2	3	4	5	6	7	8	9
Belmont	x								
General Electric						x			
Litton	x								
Marksman II	x								
Oralix	x								
Philips Oralix Super 50	x								
Pro-fix-array	x								
Ritter							x		
SS White 60-90				x					
SS White Panorex	x								
Universal		x							
Weber		x							

16 Surveys did not answer this question.

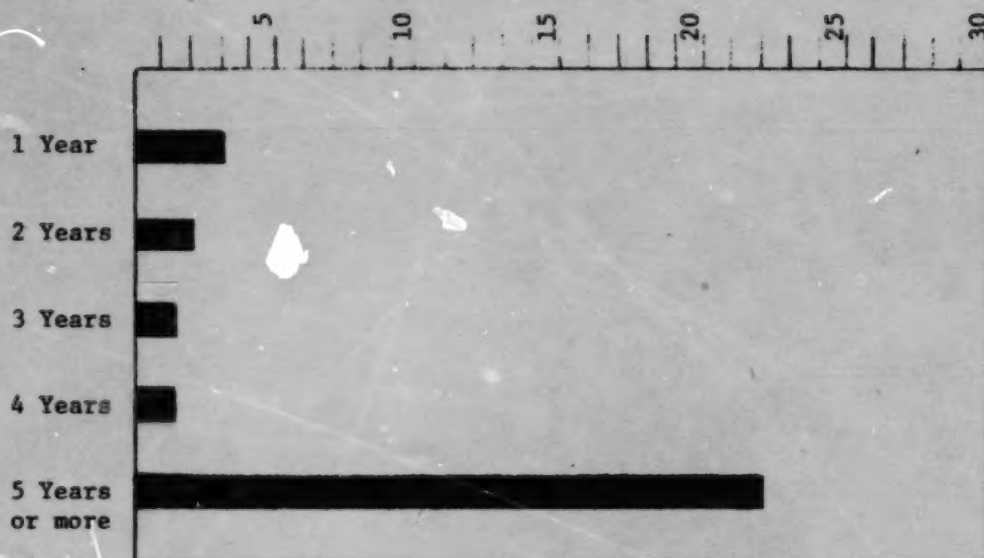
Conclusion:

As shown in Table 7, there are a wide variety of the manufactured brands of dental x-ray machines in use in the Vocational Technical Schools of Pennsylvania. The General Electric and Ritter machines are found to be the brands most frequently purchased.

QUESTION #2

How old is the machine?

Table 8. Age of the Dental X-ray Machine.



12 Surveys did not answer this question.

Conclusion:

In Table 8, most of the responding programs are using dental x-ray machines that are five years or more old. This is understandable since most of the programs have been in operation five years or more.

QUESTION #3

What type of cone does the machine have?

Of the responding surveys, eleven programs used dental x-ray machines with a pointed cone and twenty with a cylindrical cone head. There were twelve surveys that did not respond to this question.

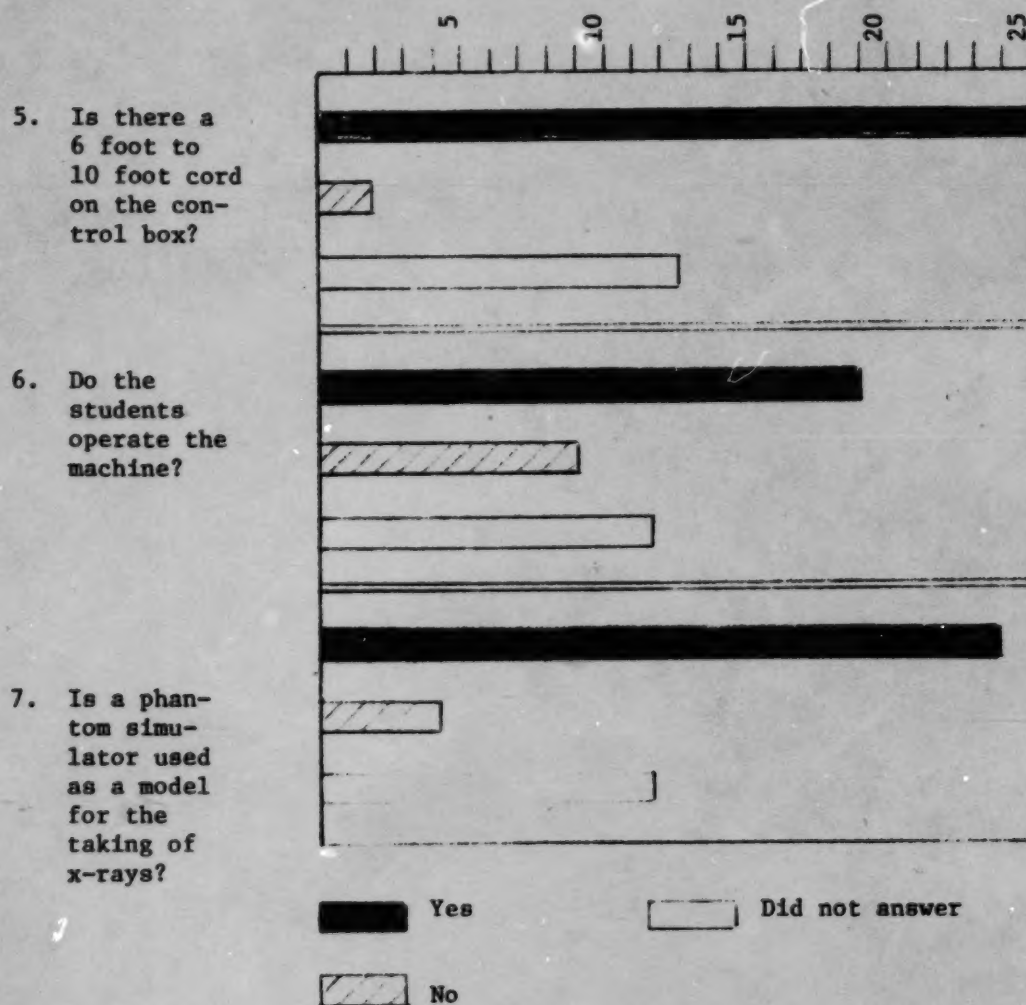
QUESTION #4

Is the machine portable or stationary?

There were five responding programs that had dental x-ray machines that were portable and there were twenty-four that were stationary. There were eleven surveys that did not answer this question.

QUESTIONS #5, 6, 7

Table 9. Features and Functions of Dental X-ray Machines.



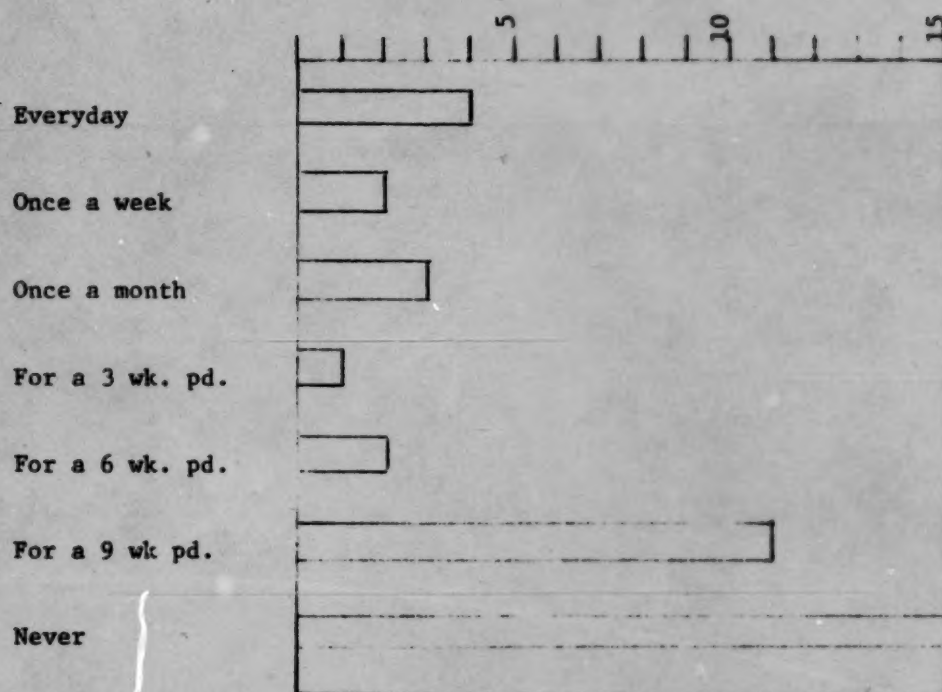
Conclusion:

As found in Table 9, most of the programs have machines with the six to ten foot cord on the control box. In order to use the machine in the classroom, they have phantom simulators available for the models of the x-rays.

QUESTION #8

How often is the machine used?

Table 10. Use of the Dental X-ray Machine.



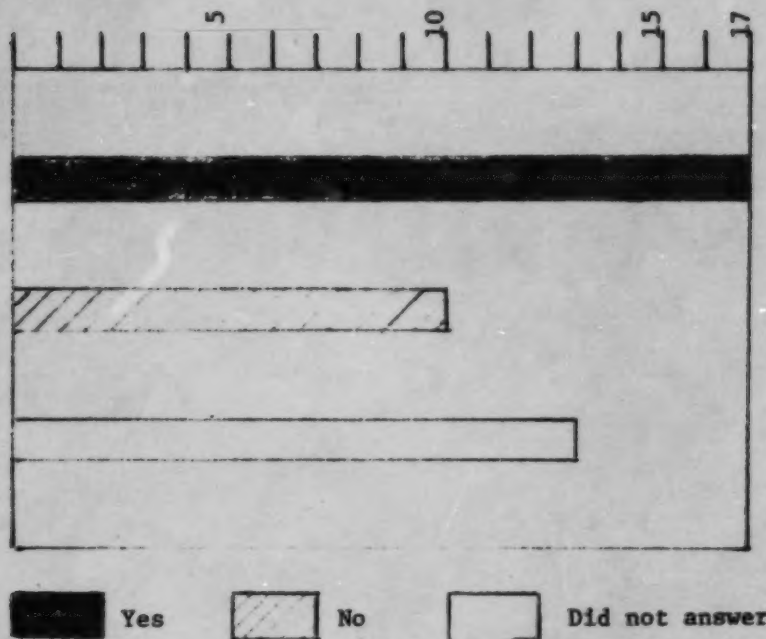
Conclusion:

In Table 10, it is shown that most of the responding programs use the dental x-ray machine for a nine week period of instruction. An interesting statistic found in this survey was that six of the programs did not have dental x-ray machines even though Dental Assisting is taught in the course and five of the programs had machines that were non-operable.

QUESTION #9

Is there a protective lead shield available for the operator?

Table 11. Use of Protective Lead Shield.



Conclusion:

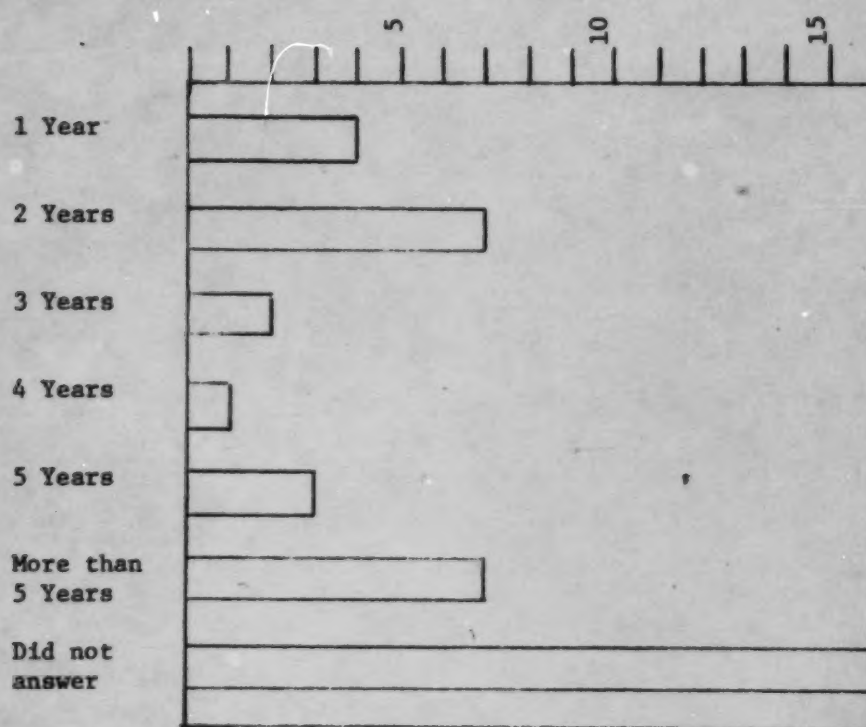
In Table 11, most of the programs have a protective lead shield available for the operator of the dental x-ray machine. One survey explained that there was not one available because the controls were not located in the room with the machine.

QUESTION #10

Has the machine been inspected by the Pennsylvania Department of Environmental Resources within the last

Year 2 Years 3 Years 4 Years 5 Years More than 5 years

Table 12. Inspection of Dental X-ray Machines by the Pennsylvania Department of Environmental Resources.



Conclusion:

As found in Table 12, a majority of the responding programs were within the recommended limits of the machines being inspected every four years. There were a sufficient number that are in need of inspection again.

ROOM STRUCTURE

Which of the room designs found on the following page is nearest to the design of your classroom?

_____ A _____ B _____ C _____ D _____ None

If the answer is none, please give a brief sketch of your classroom.

Of the responses, seven answered A, two were near B, none answered C or D and twenty-four responded to none. There were sixteen surveys that did not respond to the question.

In the response to the second part of the question, some did not include a sketch of their room. Of the ones who did, twelve of the programs would have to take some precautions when operating the machines to protect the students from radiation due to the lack of screening or a wall. Eight of the rooms had the x-ray machine in an enclosed area.

Summary

Of the nineteen Dental Assistant and the sixty Health Assistant programs polled, twelve Dental Assistant, twenty-seven Health Assistant and one Medical Health Technology programs responded.

The questionnaire was divided into four main divisions. The first section focused on the program offered. Of the responding programs, thirty-seven of the schools have been in operation for five years or more and twenty-two of the programs began when the school opened. The trend for the length of the program was one to two years of instruction.

The second part of the survey analyzed the structural materials of the room in which the dental x-ray machine is contained. The majority of the responding programs did not know the materials or did not answer the questions. Of the responding, the structural wall sections of the room are made of concrete but the majority did not know the thickness of the wall. The majority of the rooms in which the dental x-ray machine is used does not have a lead door leading to the classroom or a safety lock on the door, if there is one. There are also no lead lined draperies to protect the students from any scattered radiation from the natural glass windows. In some of the classrooms, there are lead screens available to protect the other areas of instruction from exposure to radiation.

Of the responses to the dental x-ray machine portion of the survey, there are some programs that did not have dental x-ray machines even though dental assisting is part of their course of instruction. There are also some programs that have machines that are non-opera-

tional or classes in which the students use the machine for mock demonstration only. Most of the machines in the programs have been used five years or more and are stationary in their position. The majority of these machines are designed with a cylindrical head cone. In most of the classrooms, there are protective lead shields available for the operator to use and also a six to ten foot cord on the control box. In the course of instruction, most of the programs use the dental x-ray machine for a nine week period of instruction with a phantom simulator used as the model. The majority of the dental x-ray machines have been inspected by the Pennsylvania Department of Environmental Resources within the last four years as recommended.

Chapter V

SUMMARY AND RECOMMENDATIONS

Summary

When a student is being instructed in the care and use of dental x-ray equipment, it is very important that precautions are taken to prevent any unnecessary over exposure to radiation. Over exposure to radiation can have immediate as well as long lasting genetic effects.

There has been little research so far in the methods by which protection from radiation is employed in the Vocational Technical Schools of Pennsylvania. It was the purpose of this study to identify the common structural materials, classroom design, protective features of dental x-ray machines and other protective measures from radiation.

The Pennsylvania Department of Environmental Resources was contacted for recommendations of guidelines. From the information received and other appropriate literature, a survey form was designed. This survey questionnaire was sent to all of the Dental Assistant and Health Assistant programs in the Vocational Technical Schools of Pennsylvania.

It was found in compiling the data that the majority of the programs offering Dental Assisting in their course of instruction have been in existence for five years or more. The length of the programs proves to be a one to two year course offering throughout Pennsylvania.

Of the surveys returned, concrete was the predominate material used in the structural wall sections however, the thickness of this material was generally not known.

Of the responses, most of the doors leading to the room containing the dental x-ray machine did not contain lead, leaded glass view window or a safety lock. No protection was afforded at any natural glass windows against radiation in most of the classrooms.

Most of the dental x-ray machines have been used five years or more in their existing departments. The programs satisfied the safety requirements for the proper length of the cord of the control box of the machine and provided a protective lead shield for the operator.

The classroom design in most cases would necessitate the provision of adequate shielding to protect the students from unnecessary radiation exposure. In most of the classrooms, the dental x-ray machine was epoused to the other areas of instruction.

Conclusions

Of the programs responding, the majority of the programs offering Dental Assistant in the course of instruction have been in existence for five years or more and began when the school was opened. The length of the course offering is from one to two years throughout Pennsylvania.

The majority of the instructors do not know what protective structural materials have been used in the wall sections of their classrooms. Of the few who were knowledgeable of this fact, concrete was the predominate material used, but the thickness of the material was generally not known.

The safety features of lead lined doors, leaded glass view windows and safety locks on the door leading to the room containing the dental x-ray machine are not available in most of the Vocational Technical Schools of Pennsylvania.

The classrooms in which natural glass windows are a portion of a wall section are not provided with lead lined draperies to protect the students against scattered radiation. The majority of the classrooms which were designed with the dental x-ray machine exposed to the remainder of the instructional area were also not provided with a leaded type screen to protect the students in these areas from exposure to radiation.

The majority of the dental x-ray machines that are in use in the Vocational Technical Schools of Pennsylvania were purchased five years or more before this survey was made. Because of the number of years these machines have been in existence, it is imperative that they be examined periodically by the Pennsylvania Department of Environmental Resources for leakage of radiation. Most of the programs responding were in compliance with the recommended inspection period of every four years.

Of the responding programs in which the students actually operate the machine, the majority of the programs provided the operator with a protective lead shield, used a phantom simulator and used a machine featured with a six to a ten foot cord on the control box which would permit the student to be stationed away from the useful beam of the x-ray machine. A number of the programs do not permit the students to operate the machines.

The survey concluded that most of the programs use the dental x-ray machine for a nine week period of instruction. An interesting statistic was that even though Dental Assisting is included in the course of instruction, six of the programs do not have dental x-ray machines and five of the programs have machines that are non-operable.

Recommendations

It is recommended from this study that

(1) Another study be conducted with an emphasis on the need for information concerning the structural wall materials of the Dental Assistant classroom.

(2) That all of the programs offering Dental Assisting in the course of instruction be provided with current dental x-ray machines and protective devices.

(3) That the Vocational Technical Schools of Pennsylvania evaluate their protective devices for dental x-ray machines.

(4) The instructors of the Dental Assistant programs participate in an in-service education course for the operation of dental x-ray equipment and necessary protective devices.

(5) Students enrolled in the Dental Assistant programs receive actual practice along with the instruction of taking dental x-rays in the classroom.

(6) That a survey be conducted of recent graduates of Dental Assistant programs of the Vocational Technical Schools of Pennsylvania to determine if the academic and laboratory experience in the classroom prepared them adequately for employment in the use of dental x-ray equipment.

(7) That a survey be conducted of employers (dentists, clinics, etc.) to evaluate the recent graduates of the Dental Assistant programs of the Vocational Technical Schools of Pennsylvania.

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APPENDIX A

LETTER FROM PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES

COMMONWEALTH of PENNSYLVANIA



DEPARTMENT OF ENVIRONMENTAL RESOURCES

BUREAU OF RADIOLOGICAL HEALTH

P. O. Box 2063
Harrisburg, Pa. 17120

Tel: 717 787-3720
787-3479
787-2163

May 2, 1977

Ms. Dolores Hominsky
1309 Carson Street
Connellsville, Pennsylvania 15425

Dear Ms. Hominsky:

As requested by Ms. Anita Bolton, Millersville State College, I am enclosing the applicable chapters of the Pennsylvania Regulations for Radiological Health. The specific requirements for intra-oral dental radiographic installations are contained in paragraphs 229.41 through 229.46.

X-ray facilities must be provided with sufficient shielding to meet the requirements of paragraphs 227.11 and 227.31. The Department, however, does not provide shielding consultation, but we are enclosing lists of certified health and radiological physicists whom you may contact, if you so desire, for advice concerning radiation shielding.

In addition, we are enclosing architectural guidelines for the design of x-ray installations. These guides were compiled from notes taken at various architectural seminars; they are for your convenience only and do not bear the endorsement or approval of the Department. More detailed information on structural shielding design is provided in NCRP Report No. 35. A copy of this report can be obtained from NCRP Publications, Post Office Box 30175, Washington, D. C. 20014.

The application of x-ray to human beings for training or demonstration purposes is prohibited by the regulations. Phantoms simulating all necessary human characteristics should be used for this purpose. A commercial phantom is presently available; however, the cost is quite high. We have been advised that a modified version of the commercial phantom may now be available at a much lower cost. For more information contact the Division of Vocational Program Development, Bureau of Vocational Technical and Continuing Education, Department of Education, Harrisburg, Pennsylvania.

If you have any questions, please do not hesitate to contact me.

Very truly yours

A handwritten signature in cursive script, reading "Donald J. McDonald".

Donald J. McDonald, Chief
Division of Radiation Control

Enclosures
DJM:db

APPENDIX B

LETTER OF TRANSMITTAL - SURVEY

1309 Carson Street
Connellsville, PA 15425

Dear Health Occupations Educator,

There are many methods by which the recommendations of the Pennsylvania Department of Environmental Resources may be met in planning for a Dental Assistant Program. This survey is to provide information for future planning of Dental Assistant Programs in Pennsylvania.

The information collected in this survey will remain confidential and will be grouped together for statistical purposes only. No data from individuals or schools will be identified in the summary of the data.

I am conducting this survey as a partial requirement for the Master of Education Degree at the Pennsylvania State University. I would appreciate a prompt return of the enclosed form.

Thank you for your cooperation and assistance in completing the survey.

Sincerely,

Dolores J. Hominsky
Dolores J. Hominsky

APPENDIX C

SAMPLE SURVEY QUESTIONNAIRE

PROGRAM

1. How many years has the school been in operation?

☐ 1 year ☐ 2 years ☐ 3 years ☐ 4 years ☐ 5 years or more

2. What is the title of your program?

☐ Health Assistant ☐ Dental Assistant ☐ Medical Assistant

3. If the answer to questions (2) is not dental assistant, is dental assistant taught as part of your program?

☐ Yes ☐ No

4. Did the program begin when the school was opened for operation?

☐ Yes ☐ No

5. How many years has the program been in operation?

☐ 1 year ☐ 2 years ☐ 3 years ☐ 4 years ☐ 5 years or more

6. What is the length of your program of instruction?

☐ 1 year ☐ 2 years ☐ 3 years

DENTAL X-RAY ROOM

1. The structural wall section of the room which contains the dental x-ray machine is made of

☐ A. Concrete ☐ inches
☐ B. Lead shielding ☐ inches
☐ C. Gypsum board ☐ inches
☐ D. Do not know

2. Is the door leading to the room which contains the dental x-ray machine made of lead?

☐ Yes ☐ No

3. If the door leading to the room which contains the dental x-ray machine has a lead view window, is it made of leaded glass?

☐ Yes ☐ No

4. Is there a safety lock on the door leading to the room which contains the dental x-ray machine?

☐ Yes ☐ No

5. Answer this question only if the classroom containing the dental x-ray equipment is located on the second floor of the building.

Is the floor of the room constructed with

☐ A. Concrete ☐ inches
☐ B. Lead shielding ☐ inches
☐ C. Do not know

6. Answer this question only if the classroom containing the dental x-ray equipment has a classroom located above it.

Is the ceiling of the classroom constructed of

- ☐ A. Concrete ☐ inches
☐ B. Lead shielding ☐ inches
☐ C. Gypsum board ☐ inches
☐ D. Do not know

7. Are any natural glass windows in the room which contains the dental x-ray machine covered with lead lined drapes?

☐ Yes ☐ No

8. If none of the above mentioned specifications are in effect, can the dental x-ray area be enclosed with a complete lead screen - ceiling to floor?

☐ Yes ☐ No

DENTAL X-RAY MACHINE

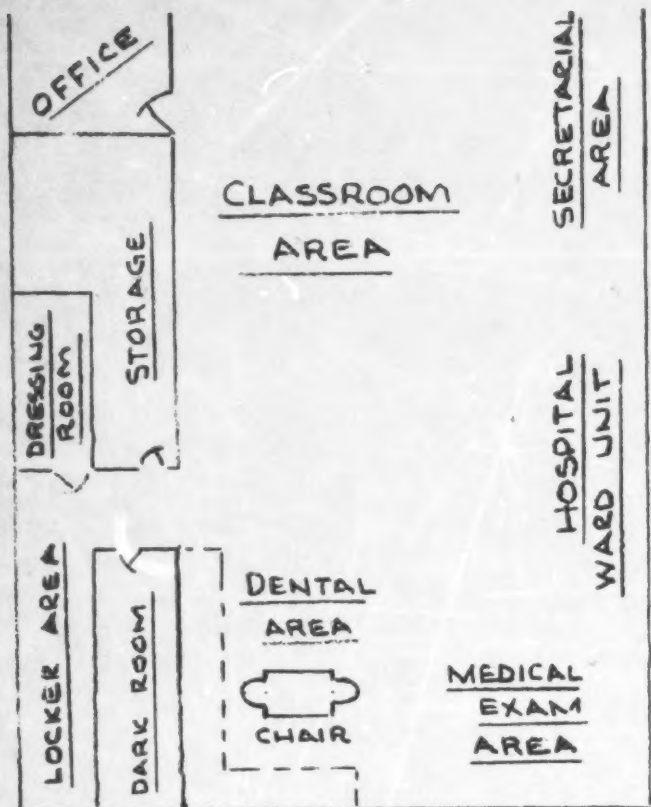
1. What is the brand name of the dental x-ray machine used in the program?
2. How old is the machine?
☐ 1 year ☐ 2 years ☐ 3 years ☐ 4 years ☐ 5 years or more
3. What type of cone does the machine have?
☐ Pointed cone ☐ Cylindrical
4. Is the machine portable or stationary?
☐ Portable ☐ Stationary
5. Is there a 6 foot to 10 foot cord on the control box?
☐ Yes ☐ No
6. Do the students operate the machine?
☐ Yes ☐ No
7. Is a phantom simulator used as a model for the taking of x-rays?
☐ Yes ☐ No
8. How often is the machine used?
☐ Every day ☐ Once a week ☐ Once a month ☐ For a 9 week pd.
9. Is there a protective lead shield available for the operator?
☐ Yes ☐ No
10. Has the machine been inspected by the Pennsylvania Department of Environmental Resources within the last
☐ Year ☐ 2 years ☐ 3 years ☐ 4 years ☐ 5 years
☐ more than 5 years

ROOM STRUCTURE

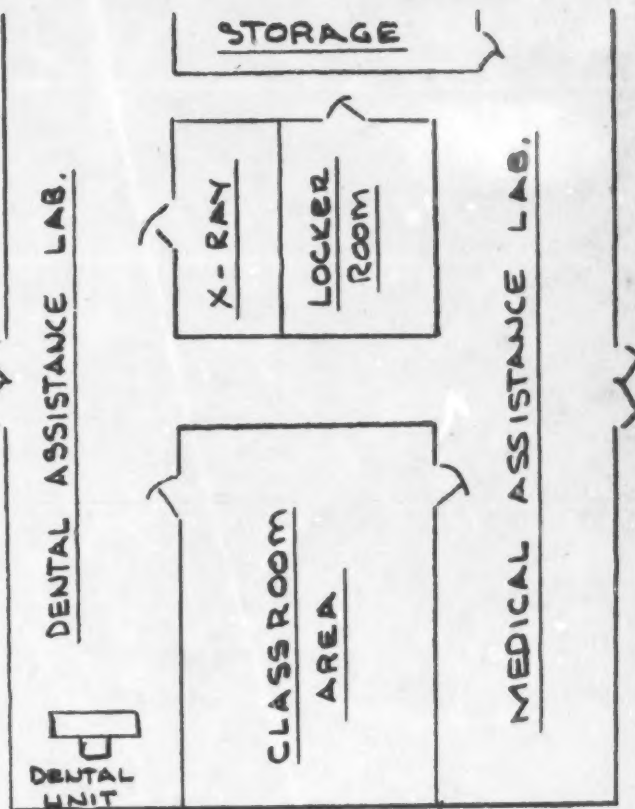
1. Which of the room designs found on the following page is nearest to the design of your classroom?

☐ A ☐ B ☐ C ☐ D ☐ None

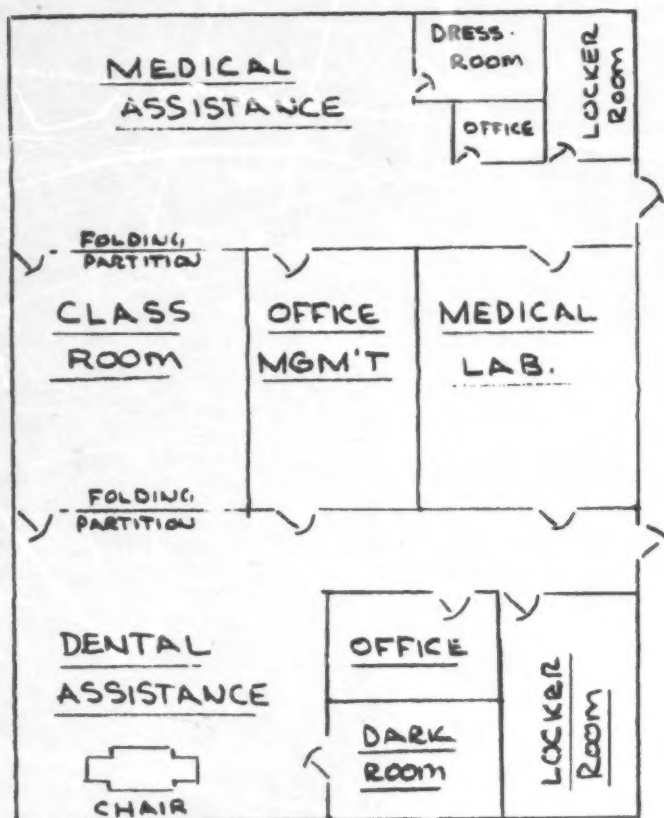
If the answer is none, please give a brief sketch of your classroom.



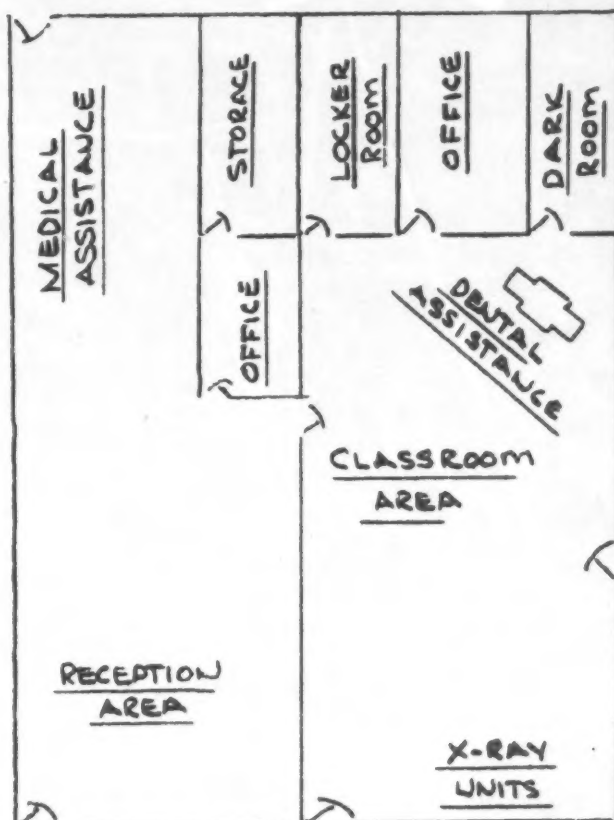
(A)



(B)



(C)



(D)